

**(Japanese patent application laid open No. H05-024873)****Brief Description of the Drawings**

Fig. 1 is a diagram showing the relationship between the Cl amount on converting a silica glass into transparent glass and the residual stress of a fiber.

Fig. 2 is a diagram showing the relationship between the Cl amount on converting a silica glass into transparent glass and core-cladding index differences of a fiber.

Fig. 3 is a diagram illustrating the relationship between the Cl amount on converting a silica glass into transparent glass and  $\lambda_c$ , MFD of a fiber.

Fig. 4 is a diagram illustrating the gradient index of a pure silica glass-fluoridation silica cladding fiber.

Fig. 5 is a schematic diagram showing a manufacturing method of a glass particle body.

Fig. 6 is a schematic diagram showing a sintering method of a porous host material.

**Reference Numerals**

1--- glass particle body, 2--- burner, 3--- start member, 4--- heater, 5--- furnace cardiac tube, 6--- exhaust, 7--- He, Cl gas, 10--- residual stress, 11, 21, 31--- Cl amount, 12, 22, 32--- comparative example 1, 13, 23, 33---embodiment 2, 14, 24, 34--- embodiment 1, 15, 25, 35--- weight, 20--- index difference, 26--- index difference in case of the preform measurement, 36, 37--- predicted value

**Claims**

"1. A method of manufacturing a glass preform for an optical fiber to obtain a glass base material by the steps of dehydrating a silica-based porous base material and converting silica-based porous base material into transparent glass, wherein 0.1~1 percent by weight of halogen is included in a silica glass by heating said glass preform in an atmosphere including halogen gas in the steps of dehydrating and/or converting, and said glass base material obtained by this is used as a core for an optical fiber.

2. The method of claim 1 wherein said halogen is Cl.

**Paragraph [0005]**

[Operations] The core-cladding index differences was measured from the configuration ( $\lambda_c$ , MFD), the residual stress and the gradient index of a fiber by manufacturing a single mode fiber as the silica base material is a core with, by using Cl as a halogen for investigating effects of the viscosity of said pure silica glass, analyzing the amount of Cl in the silica glass by an ion chromatograph method and quantifying the amount of Cl. As increasing the amount of Cl, the residual stress in the fiber was reduced, in result, it was apparent that the core-cladding index differences approaches the value

measured at a preform state (Figs. 1 and 2). Also, the fiber configuration ( $\lambda_c$ , MFD) almost corresponded to a predicted value at a preform stage (Fig. 3). As described above, since the viscosity of said pure silica glass could be decreased by increasing the amount of Cl in the pure silica glass, the fiber configuration may not deviate from a predicted value at a preform stage, and since the dependency for a drawing condition is also reduced, it has effects on manufacturing a pure silica core single mode fiber. It is preferred that the amount of Cl in the pure silica glass is 0.2~1 percent by weight. It is not preferred that the amount of Cl in the pure silica glass is 0.1 percent by weight, because the fiber configuration deviates from a predicted value at a preform stage. Moreover, since the content having almost 1% by weight almost corresponds to a predicted value of a preform, the inclusion beyond 1% by weight is not needed. Furthermore, much the same was true on additions of other halogen elements having effects on reducing the viscosity of a silica glass. Since fluorine also has effects on reducing the refractive index, it is required that to add fluorine to a cladding more than the amount of adding to a core in case of adding fluorine. Iodine (I) and bromine (Br) have a beneficial effect, however, it is advantageous to use Cl gas in view of having the biggest dehydration action and having no effect on the refractive index. As Cl gas, for example,  $\text{Cl}_2$ ,  $\text{CCl}_4$ ,  $\text{SiCl}_4$ ,  $\text{SOCl}_2$  and  $\text{SCl}_2$ , etc. could be cited. However, it is able to use Cl gas for carrying out, for example, only a dehydration processing and to use other halogen gases for converting into transparent glass, and vice versa."

Paragraph [0006]

"Actually, in order to include halogen in the pure silica glass in the range of 0.1~1% by weight, a porous base material is converted into transparent glass by heating the porous base material in the range of 1000~1700°C under an atmosphere including a halogen compound and inert gas and having the atmospheric pressure~ about 3kg/cm<sup>2</sup> pressure. More specifically, the heat treatment of a porous base material in an atmosphere including halogen compound gas may be carried out by any step of the following steps: (a) the step of dehydrating the porous base material, (b) the step of converting the porous base material into transparent glass and (c) the step of dehydrating the porous base material and converting the porous base material into transparent glass, it is especially preferred to carry out the heat treatment by the (a) or (c) step. The addition amount could be controlled by an adjustment the gas concentration and processing temperature, etc., however, the width of the adjustment is up to half time at most in experiments by the present inventors. The selection from halogen compound gases is preferably useful in adjusting the addition amount, for example, the addition amount changes from 0.2~0.4 percent by weight in case of using Cl gas to 0.5~0.8 percent by weight in case of using  $\text{SiCl}_4$  gas. Thus, the content could be greatly changed by kinds of gas used. By the way, a porous base material used in the present invention could be used a porous base material made by a well-known means in this kind of technical field, i.e., for example, a porous base material by a gas-phase synthesis such as VAD method and OVD method, etc., but is not limited to. Also, the bulk density of a porous base material is not limited, however, the bulk density of a porous base material is generally around 0.2~0.4 g/cm<sup>3</sup>. Moreover, a porous body of pure silicate was shown in the above description, however, a silicate-based porous body could be used."